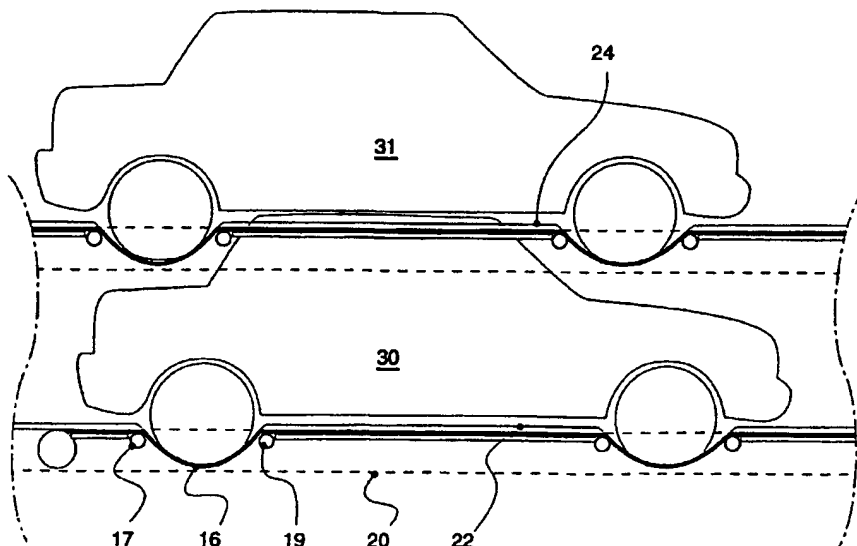




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(54) Title: (VEHICLE) LOAD MOUNTING IN CONTAINER



## (57) Abstract

Containerised vehicles (30, 31) are stacked, one upon another, at different load deck levels, and packed closer together, by localised wheel support and/or capture, using adjustable (tension or span) cradles, slings, or saddles (15), upon 'U' or 'C' support frames, or by movable deck shutter panels, mounted upon the container chassis (20), and/or support posts; allowing localised intrusion into a vehicle underbody ground clearance, by an adjacent underlying vehicle, upon another deck, for greater packing density, particularly for taller vehicles; local re-orientation and re-disposition of deck portions relative to others is also envisaged.

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**(Vehicle) Load Mounting in Container**

This invention relates to load mounting, stacking, packing and inter-nesting, and is particularly, but not exclusively, concerned with containerised load disposition.

- 5 A case in point is vehicle packing, as multiple individual loads, in a dedicated load (vehicle) container, such as a (road) transporter or (railway) carriage, or for so-called 'inter-modal' (eg. from road, rail, shipping to even air freight) transportation and storage.

**Load Support Upon Load Deck**

In a conventional container a load is supported upon a common load deck.

- 10 The Applicant has proposed a multiple entrained deck container, with a common deck support structure, albeit allowing relative deck movement, in his PCT (ex-UK) Patent Application WO98/09889 (GB97/02319).

Similarly, the Applicant has envisaged multiple independent deck modules, in his UK Patent Application GB0011433.0.

- 15 Whilst deck segmentation into subsidiary deck portions was allowed for in both these cases, the deck essentially defined the load support level or height.

The present application seeks to break from that constraint or direct relationship between deck and load level.

- 20 This is particularly relevant for dedicated vehicle transporters for so-called 'multi-purpose vehicles (MPV's)' or 'people carriers', which conventional containerised configurations would find it difficult to accommodate - at least without substantial voids and so wasted load capacity.

Accommodating an internal load requirement within a prescribed overall container

profile, makes relative deck movement advantageous, to allow closer load packing and stacking, by bringing decks together after loading.

5 A relatively compact container transit mode is thus achieved, enabling passage through tight route constraints, such as tunnel gauges - reverting to relatively 'expanded' format for (un)loading.

Thus, in the case of a (dedicated) vehicle container, drive-on/drive off (un)loading is preserved at docking stations, yet vehicles are closely-packed, in a compact overall containerised configuration or format, for transit.

10 Aspects of the present invention seek even closer load inter-nesting, to allow even tighter packing or greater packing densities.

In some instances, load support which allows relative load and deck movement - such as lowering a (vehicle) load support level in relation to an overall deck level - may achieve closer packing.

15 In other instances, a more compact load packing and transit form is achievable by a relative load and deck movement which effectively reduces the intrusion of the deck itself upon the load - and in particular the load upon another (say, underlying) deck.

#### Statement of Invention

The present invention provides a container featuring:

- load support, with a degree of independence from deck level, and/or
- 20 • relative load level and deck level movement.

#### Containerised Packing

Since containerisation applies rigorous, standardised (load-independent) confines upon a load, yet individual and collective load profiles may vary - particularly in the case

of vehicles - optimising vehicle packing within a container or dedicated transporter is crucial for economic transport handling and storage.

Even with a conventional dedicated vehicle container, vehicle packing and stacking leaves substantial (redundant) voids around and between vehicles.

- 5        These voids are considerably more than necessary merely to provide a modest clearance between vehicles, to allow for vehicle movement in transit, without contact between vehicles.

However, in a conventional (vehicle) load stacking approach employed hitherto, such voids cannot be employed constructively as usable (vehicle) load space.

- 10       Essentially this is because the vehicles simply cannot be brought close enough together, or relatively positioned, or orientated, to allow a closely inter-nesting, snug inter-fit of respective outer contours.

- 15       In conventional (vehicle) load packing and stacking, for transport and storage, (road) vehicles generally stand upon their ground running wheels - and in that stance enjoy a certain under-floor operating margin, or so-called 'ground-clearance'.

Similarly, a flat deck, or deck portion, whilst convenient for vehicle (un)loading, impedes penetration or intrusion into that vehicle's ground clearance, with or by another load component - specifically, some part or the entire span of another vehicle.

20       Statement of Invention

- Some aspects of the invention provide a vehicle support and positioning regime, through a localised wheel capture module, enabling carefully controlled 'intrusion',  
25       or penetration, of one vehicle, towards the floorplan of another stacked overlying vehicle.

However necessary such ground clearance may be for on-road use, the Applicant has recognised it as somewhat of a 'redundant void', in the pursuit of dense vehicle stacking and packing.

- 5 Similarly, each vehicle might be regarded as having some associated or 'personal' peripheral 'bounding' space - allowing a comfort or safety margin, before (potentially deleterious or damaging) contact with another object, such as an adjacent vehicle.

#### Vehicle Re-Orientation & Re-Disposition

- 10 Once freed from the inhibition of flat platform support surfaces for the wheels, diverse relative orientations of vehicles can be employed, in bringing them closer together, for dense(r) stacking and packing.

Thus, for example, wheels of an overlying vehicle may be nested in the roof-to-bonnet, or roof-to-boot outer contours, or 'transition profiles', of an underlying vehicle.

- 15 Similarly, the wheels of an overlying vehicle may be disposed alongside the upper sides and roof line of an underlying vehicle, relying upon the waisted or tapering (width) profile of the underlying vehicle, from the wheels up to the roof line.

#### Localised Wheel Capture

- 20 In a refinement of the proposition according to one aspect of the invention, the Applicant envisages localised 'capture' or embrace of vehicle wheels - or rather localised capture, embrace, retention and manipulation of an overall vehicle, collectively through its wheels .

This in turn allows a greater freedom of vehicle location, in relative disposition with other vehicles, similarly captured - yet consistent with the bounds of containerisation.

- 25 A practical implementation of such individual wheel capture employs a profiled (ie. to complement an individual wheel lower contour) mounting, upon a (movable) support

arm, for a vehicle wheel - at each corner of a vehicle to be captured as a whole.

Such localised mountings may be installed upon a common support arm, or rather the support arms of individual such wheel mountings may be integrated.

5 Thus, for example, a 'U' or 'C'- support frame, spanning transversely of the vehicle track (ie distance between wheels on opposite vehicle sides), may be installed at each end of a vehicle, with spaced extension arms carrying respective profiled cradles or saddles, to accommodate and support vehicle wheels.

The cradles or saddles could be, say, spaced rigid bars, or rungs, extending transversely across the vehicle track between longitudinal chassis rails.

10 Alternatively, a fabric (say, robust canvas) sling could be disposed between spaced such rungs - with adjustable tensioner provision.

Thus, with a 'slack' such sling, an individual vehicle wheel would sink deeper into the confines of the sling - which in turn would wrap around a greater proportion of the lower wheel, or rather tyre, circumference.

15 Conversely, with a 'tauter' such sling, an individual vehicle wheel would sit 'prouder' or higher, with less wrap around of the lower wheel contours by the sling fabric.

A taut sling could equate generally to a rigid level surface, with similar tyre contact footprint, and insignificant local sling depression.

20 The support frames can themselves be mounted upon a container chassis - in particular the upright corner end posts - using adjustable jacking carriages.

Alternatively, the support frames could be carried by (longitudinal) side chassis rails - say, using height-adjustable and longitudinally movable mountings.

Through provision of an adjustable mounting, the relative heights of the support frames can be adjusted, to change the load height and inclination or tilt of a supported

or 'wheel-cradled' vehicle.

Some transverse adjustment might also be incorporated, to facilitate fitment of a cradle or sling to the track and wheel-base of individual vehicles.

5 For vehicle (un)loading, it is convenient to provide a continuous or part-continuous running surface for vehicle wheels.

Thus narrow ramps, a couple of tyre tread widths or so deep, could be configured as multiple ladder rungs, of a span between rungs sufficient to bridge a wheel tyre segment at less than full diameter.

10 However, once the vehicle wheels have been captured locally in support slings or cradles, the running track - or at least that portion between the front and rear wheels at each side - could be (re)moved altogether, allowing access (by, say, the roof of another underlying vehicle) to what would otherwise be preserved as ground-clearance.

15 Such selective ramp removal would allow mutually overlying or stacked vehicles to be brought (much) closer together - in a snug, closely inter-fitting, inter-nesting storage configuration, with significantly increased packing density, and thus more efficient use of the restricted available load space in containerisation.

20 Thus, for each vehicle deck or load layer, vehicles may be carried lower in the deck depth - so that when decks are brought together (ie an upper or overlying deck is lowered upon an underlying deck), the overlying vehicle rows occupy less overall depth.

This in turn helps accommodate taller vehicles within standard containerisation confines - albeit at the modest penalty of more elaborate (un)loading cycles.

25 More efficient load packing is even more critical as certain vehicles become taller (including so-called people carriers, 4 wheel drive off-roaders or sports utilities, and light vans) - and would otherwise impinge upon or 'infringe' the load space that would



be required to accommodate an overlying vehicle.

Generally, containerisation imposes constraints upon overall loading shape and size - beyond which a vehicle cannot project, without risk of impeding container stacking and inter-fit - and thus undermining the very purpose of containerisation.

- 5        Nevertheless, in certain transport modes, such as road or rail, a certain load-over-spill from the otherwise strict container confines can be admitted.

Thus, for example, at the ends of successive containers, disposed in tandem, and aligned end-to-end in a row, as with rail freight, a certain modest end over-spill can be countenanced, relying upon the coupling interval between successive containers.

- 10       Dedicated vehicle containers are commonly configured to allow loading and unloading by driving the vehicles directly onto and off from an end.

Vehicles are generally carried upon a load platform or deck - which may be minimal, for example spaced runways or tracks for the vehicle wheels.

#### Supplementary Statement of Invention

- 15       According to one aspect of the invention,  
a dedicated vehicle container  
is fitted with wheel ramps or tracks,  
incorporating localised 'departures',  
such as depressions or gaps,  
20       achieved through, say, movable sections,  
to allow a vehicle to sink down closer to the track run,  
and lower the load height of the vehicle;  
in turn allowing vehicle stacking,  
with an overlying upper vehicle nesting into closer conformity over an underlying  
25       lower vehicle.

Conveniently, localised sections of the track can be selectively (re)moved - in

particular lowered - relative to the remainder of the track.

Alternatively, localised sections of track can be removed altogether from the remainder of the track.

5 In either case, the vehicle underside and sills are brought closer to the remainder of the track.

#### Deck Shutters

Localised deck portions could be configured as shutters, that is multiple entrained panels which can be deployed between extended and retracted positions.

10 Thus, for example, an extended position could be used for (vehicle) loading on that particular deck, and a retracted position to create operating clearance for a load upon another (underlying) deck.

Such retractable deck shutters could be localised, or extend along substantial portions of the overall deck span.

15 Deck shutters could be supported - for example cantilevered inwards - from longitudinal deck chassis rails.

Deck shutters could be supported upon an over-centre linkage, for snap-action transition between retracted and extended positions, in each of which the linkage configuration biases, restrains or latches them to remain in position, until a sufficient displacement force is applied.

20 Alternatively, deck shutters could run along a guide track, say from a generally level extended position, to an upright retracted position, alongside a load and longitudinal deck support chassis rails or beams.

An even simpler variant would be a removable, localised deck panel segment, deployable for local load support, such as beneath a vehicle wheel, and removable to

rest along a longitudinal deck chassis rail, until required.

In any of these constructions, relative deck movement - and in particular movement of an upper deck (on which such deck shutter provision is most relevant) relative to a (say, static) lower deck is envisaged.

- 5      Particularly with dedicated containerised vehicle transporters, such as those configured as railway freight wagons, the deck shutter principle could be extended to continuous entrained or inter-coupled shutter array, itself forming a (temporary) deck surface, or (un)loading ramp, for drive-on/drive off (un) loading.

- 10      Once a vehicle is loaded, with its wheels resting upon (permanent) localised deck sections, the intervening or bridging temporary deck shutter could be retracted (for example rolled up, or slid, to a parking position, say in a recess in the main deck surface).

- 15      Deck shutter (un)loading ramp retraction leaves a greater clearance below the vehicle, into which the roof of an underlying vehicle could be brought, by say relative deck movement - in particular lowering of an upper (overlying) deck towards a lower (underlying) deck.

Generally, for dedicated vehicle containers, such shutters need only be configured as wheel ramps, tracks, runners or guides.

#### Slings

- 20      Aside from shutters or panels, localised (re-)movable track portions can be configured as flexible (fabric) slings, belts or bands, selectively tensioned - to bridge an interval in the track; and relaxed - to allow lowering of a vehicle upon the remainder of the track.

The slings can be suspended between spaced end fittings, themselves movably mounted in intervals in the remaining track.

- 25      Thus, for example, opposed sling end fittings could be swing arms, mounted to pivot

upon the ramp, to vary their relative spacing - and thus the degree of sling tension or, conversely, slack.

### Rungs

5        Aside from shutters or slings, localised deck support elements could be configured as (movable) rungs.

Just as with a (fabric) sling, a series of such rungs could follow, in close conformity, the outer contour or profile of a vehicle wheel, including its tyre.

Alternatively, spaced rungs could take a bearing from opposite sides of a wheel along a chord line below the wheel running axis.

10       Some localised tyre deformation under a share of the vehicle load would help bring the rungs, or sling, and the wheel tyre profile in contact therewith, into much closer conformity.

### Inter-nesting

15       In a more elaborate variant, provision is made for bringing vehicles stacked, generally one upon, or at least part-overlying, another, upon respective load decks, closer together.

In an extreme case of close packing, the wheels of an overlying vehicle could sit over and alongside the roof of an underlying vehicle.

20       Advantage could be taken of any slight 'waisting' or taper of the cross-section of a (lower) vehicle, to allow the wheels (or at least the tyres) of an overlying vehicle to 'sit (somewhat) astride' the lower vehicle roof line and upper side taper.

Embodiments

There now follows a description of some particular embodiments of individual and collective vehicle load capture, mounting and (relative) disposition according to the invention, by way of example only, and with reference to the accompanying diagrammatic and schematic drawings, in which:

5

Figures 1A & 1B show an adjustable sling mounting for individual vehicle wheels, respectively with the sling tensioned to align with a rigid surrounding load deck and slackened to allow the wheels to sink somewhat below deck, bringing the vehicle underfloor closer to, and only marginally spaced from, the deck;

10

Figures 2A & 2B show an alternative adjustable wheel mounting to that of Figures 1A & 1B; respectively in an erected and relaxed condition;

Figures 3A and 3B show another adjustable wheel mounting to that of Figures 1A-B or 2A-B; using rigid trays or subsidiary platforms, and respectively in a raised and lowered condition;

15

Figures 4A & 4B show a further variant adjustable wheel mounting to that of Figures 1A-B, 2A-B, or 3A-B, using variably-spaced bars or rungs; and respectively in a raised and lowered condition, with supplementary independent provision for selective tilting of certain deck portions relative to others;

20

Figures 5A & 5B show a three-dimensional view of a cable drive for deck portion tilting facility, such as that of Figures 4A & 4B;

Figures 6A through 6C show different relative deck portion configurations, for a localised deck profile positioning and relative disposition facility, such as that featured in Figures 4A-B and 5A-B;

25

Figures 7A & 7B show - respectively in erected and collapsed conditions - front elevations of a double-deck or two-tiered vehicle transporter, with provision for relative deck height and spacing adjustment, together with an adjustable over-frame

for conformity with standardised rail tunnel profiles;

5 Figure 8 shows a double-deck, dedicated vehicle container, with laterally-folding deck panels, enabling retraction or withdrawal, upon loading, between residual vehicle wheel support deck sections, with re-instatement to form a continuous deck support surface for (un)loading;

Figure 9 shows a variant of Figure 8, with track-mounted transversely folding shutters, deployable between a retracted condition, in which they lie alongside longitudinal deck chassis rails or beams, and an extended or deployed condition, in which they form a continuous deck surface for (vehicle) (un)loading;

10 Figure 10 shows a variant of Figures 8 and 9, with removable discrete deck panel sections, between localised vehicle wheel support; and

Figure 11 shows a continuous shutter (un)loading ramp, deployed for (vehicle) (un)loading, and retractable to allow closer positioning relative to an underlying deck and attendant vehicle load, into a compact overall container transit mode.

15 Detailed Description of Drawings

Referring to the drawings, a dedicated vehicle transporter 10 comprises dual stacked or tiered decks 12, 14, for independent layered vehicle storage at different levels.

The decks are supported upon a common overall chassis frame 20.

20 Each deck 12, 14 incorporates localised adjustable 'provision' 15 for vehicle wheel capture, retention, re-orientation and re-disposition, relative to the deck level 'proper' and/or the supporting chassis 20.

Figure 1B shows an underlying vehicle 30 upon the lower deck 12, or rather in the local wheel support slings 16 on that deck.

The vehicle roof intrudes through the upper deck 24 level, and into the underfloor or

ground clearance space of a stacked overlying vehicle 31, itself captured by similar slings 25 associated with the upper deck and sitting marginally spaced therefrom.

5 In this variant, the individual wheel capture mountings 15 each comprise a fabric sling 16, suspended between spaced runners 17, 19. The sling is initially held taught, by spacing the runners 17, 19, to align the fabric generally with the associated surrounding deck level.

10 This allows a vehicle 30, 31 to be driven along a generally even deck 22, 24 level, until its wheels rest upon respective slings 16 - whereupon the sling tension can be relaxed, progressively in synchronism, to allow the wheels to sink below deck 22, 24 level - until the vehicle underside is only marginally spaced from the deck 22, 24, as depicted in Figure 1B.

In this way, the overall load height, or depth, of a given vehicle upon a deck 22, 24 is reduced somewhat - or a somewhat taller vehicle can be accommodated in a given available loading depth.

15 A comparison between Figures 1A and 1B demonstrates this point.

The individual slings could be self-contained units, with a flexible support surface, say, of robust fabric, or expansible sheet material, such as an elasticated, stretchable, concertina-link chain or band - much like an expanding watch bracelet or strap.

20 Spring steel might also be employed for the sling - which would then operate as a part-coiled spring.

As an alternative to localised slings, or rather sling bands, a continuous band surface could extend along the entire deck length.

25 Thus, for example, between individual wheel (capture) locations, the band could rest upon, or in between, longitudinal guide tracks or restraints, in order to inhibit undue sag, or deflection, between wheel (capture) locations.

At the wheel capture locations, the band surface could pass around tension guide rollers, allowing a selective local departure, in fact a controlled droop or sag curvature, from (ie below) the general deck level.

5 The overall effect would be one of a continuous elasticated or sprung band, along a substantial portion of, if not an entire deck span.

More pragmatically, the sling banding would be confined to a particular individual wheel (capture) location - in which case either an elasticated or expansible sling material, or simply a flexible one allowing selective tensioning or relaxation, could be employed between opposed guides at each end of an individual wheel (capture) location.

10

Figures 2A & 2B depict individualised, self-contained wheel capture, through flexible bands or straps, spanning associated apertures or gaps, in the load deck, at intervals generally corresponding to the wheelbase of the vehicles to be loaded.

A diversity of band fabric could be employed, from (woven) fabric, such as canvas, or thin sheet metal (eg spring steel) or synthetic plastics - or more elaborate expansible constructed forms, such as interlocking mesh.

15

The bands 16 are restrained at one end of the respective deck gap through a mounting tie 28, and can be selectively tensioned or relaxed into a sagging or droop mode, albeit of shallow curvature, below deck level, by winding or unwinding a tension roller 26 at the opposite end of the band.

20

Figure 2A depicts the bands as fully tensioned, to support a vehicle level with the surrounding load deck.

Figure 2B depicts the bands 16 relaxed, to create localised sag, around respective vehicle wheels, under the vehicle weight - whilst still supporting that weight and additional providing some fore and aft restraint by virtue of the multiple deep wheel pockets created.

25



This collective band sag in turn allows a vehicle to descend somewhat, until marginally spaced from intervening deck level between bands.

5       Figures 3A & 3B depict a variant wheel capture mechanism to that of Figures 1A-B and 2A-B, using rigid wheel trays 41, (concave-scalloped) pockets, compartments or platforms, spanning or bridging deck apertures at each wheel (capture) location and selectively movable in relation to the deck level.

More specifically, Figure 3A shows the platforms level with the intervening deck level - forming a generally even continuous deck surface for vehicle (un)loading.

10       Figure 3B shows the platforms lowered below the intervening deck level, to create a collective lower platform for vehicle carriage - again bringing the vehicle underside closer to, but marginally spaced from, the deck, and so lowering the overall load depth.

Figures 4A & 4B depict a combination of (vehicle) load capture and handling features, including a tilting deck portion 56 and movable wheel capture bars 51, 52.

15       More specifically, at a lower deck 50 a vehicle 55 rests upon individual wheel (capture) locations, configured as opposed pairs of bars or rungs 51, 52, at the inboard ends of respective pivot arms 53, 54.

20       These pivot arms 53, 54 are selectively movable, in phase, about their outboard pivot points, either into general alignment with surrounding deck level - as shown in Figure 4A, or lowered somewhat below that deck level - as shown in Figure 4B.

Respective manual (say ratchet crank), or powered drive, actuators 57, 59 may be employed to operate the pivot arms 53, 54.

25       At an upper deck level 60, one end of a vehicle 65 rests upon a hinged, tiltable deck portion 56, shown in Figure 4A fully-elevated into general alignment with the surrounding deck level.

Figure 4B shows the deck portion 56 tilted rearwardly, about a forward pivot axis, and carried by pillar 58 (with attendant drive - not shown), to allow the rear of a vehicle 65 resting upon it to descend considerably below the upper deck level 60, towards a vehicle 55 on the underlying lower deck 50.

- 5        This transition and re-orientation of the vehicle 65 pays regard to the outer contour of the underlying vehicle 55, particularly its roof to bonnet or boot level step.

Figures 5A & 5B show a twin-deck dedicated vehicle transporter wagon or carriage 70, in which an upper deck 68 has longitudinally-spaced, individually tiltable deck portions 61, 63, operated by a synchronised common cable drive 67.

- 10       Figure 5A shows the deck portions 61, 63 fully raised, into general alignment with the upper deck 68.

Figure 5B shows one of the deck portions 61 lowered at its inboard end.

- 15       Figures 6A, 6B & 6C show a twin-deck, dedicated vehicle transporter wagon or carriage, with selectively tiltable and elevatable deck portions, through the cable drive 67.

More specifically, a central deck portion 71, of an upper deck 78, can be lowered in relation to the surrounding deck level, and towards an underlying lower deck 76 - as depicted in Figure 6A

- 20       This allows an individual vehicle carried upon that deck portion to be lowered, level to overlie the bonnet lines of appropriately disposed vehicles on the lower deck.

The upper deck 78 is also movable as a whole somewhat towards the lower deck 76, with selectively movable clearance portions, for example between wheel ramps, to allow the roof lines of vehicles 77 on the lower deck 76 to penetrate somewhat the upper deck level.

- 25       Figure 6B depicts two tilting deck portions 72, 73 of the upper deck 78 deployed,

each loaded with an individual vehicle 75, canted rearwardly to follow the roof to bonnet contours of underlying vehicles 77, appropriately disposed (in particular tandem spaced) upon the lower deck 76.

5 Figure 6C shows a variant configuration of tilting upper deck portions 72, 73, in which associated vehicles 75 are tilted rearwardly, but with their respective rear ends together and intruding somewhat downwardly into an inter-deck region between vehicles 77 on the lower deck 76.

10 Figures 7A & 7B depict a twin-deck, dedicated vehicle transporter, configured as a railway wagon, with an adjustable bounding frame for conformity with standard tunnel, bridge or overhead gantry clearance profiles.

In order to accommodate more than one such standard cross-sectional profile limitation, an adjustable outer frame 84, 85, 89 is provided.

15 If necessary, reliance can be placed upon a facility to bring vehicles on the upper and lower decks somewhat closer together, for example in the manner of the preceding embodiments.

Figure 7A depicts a bounding outer frame 84, 85, 89 fully-erected, to assert a full standard container cross-sectional profile, at which container capture and handling fittings 87 are accessible.

20 Figure 7B depicts upper frame re-profiling, for conformity with a standard tunnel gauge profile 90, 91, through which the wagon must fit for safe running freedom.

More specifically, a transverse bracing header beam 83, is disposed between the upper ends of opposed support posts 81, carrying the upper and lower vehicle decks (not shown).

25 The header 83 is itself fixed, but surmounted by opposed outboard arms 85, pivoted at their inboard ends to a central bridge beam 84.

The arms 85 carry container capture and handling fittings 87 (such as proprietary so-called twist-locks) at their outboard ends.

5        Operating and support links 89 underlie respective support arms 85, and are operable through actuators (not shown), to erect the arms 85 for access to the fittings 87.

Reverse mode actuation, lowers the arms 85 to within the external tunnel gauge profile constraint 90,91.

10       The individual wheel capture modules described in the various foregoing embodiments - whether slings, space bars, or trays - may be supported upon a common frame.

Thus, for example, capture modules on opposite sides of a vehicle transporter maybe carried by a common 'U' or 'C' - frame, with a transverse limb across the transporter deck width and longitudinal stub members at opposite sides, each carrying a capture module.

15       Alternatively, such capture modules could be supported from longitudinal deck rails, at opposite sides of an intervening load deck.

Although localised capture modules, for individual vehicle wheels have been described as interrupting a load deck, portions of deck might be selectively removable between wheel supports.

20       Thus a vehicle could be loaded by driving upon what is effectively a continuous deck support surface, until its wheels rest upon localised capture and modules.

The modules could then be actuated in synchronism, collectively to carry the overall vehicle weight, without being reliant upon intervening or bridging deck portions - which could then be moved out of position, or removed altogether.

25       In either case, the deck portions would no longer represent an obstacle to bringing

individual vehicles somewhat closer together - in denser stacking and packing configurations.

5 Referring to Figure 8, a multiple, in this case twin or dual stacked or mutually overlying deck container, configured for dedicated vehicle transportation, has at least an upper, overlying, deck 107 fitted with special provision to allow an associated vehicle cargo 103 to be brought closer to a corresponding cargo 101 upon a lower deck 105.

This is achieved by relative deck movement, or re-disposition and re-orientation - and in particular, lowering the upper deck 107, relative to the lower deck 105.

10 The lower deck 105 is depicted as a continuous platform surface 106, over the entire container transverse (and indeed longitudinal) span, between longitudinal side chassis rails or beams 108.

However, the upper deck 107 is only partially in-filled transversely, being configured as peripheral ramps 115 on opposite deck sides, each ramp 115 extending only partially inboard from longitudinal upper chassis side support rails or beams 109.

15 Moreover, the upper deck ramps 115 are longitudinally fragmented, or segmented, and selectively extendible, for local vehicle wheel support, or retractable for greater underbody clearance, between such wheel support.

20 If the intended vehicle load wheel base is known, 'permanent' localised deck portions 114 could be identified for localised wheel support - with temporary, selectively-retractable, intervening movable portions bridging or spanning the wheel support portions, for (un)loading.

The localised wheel support through a residual deck platform portion 114 need not necessarily involve wheel capture, or positive fore and aft entrainment, such as is afforded by the slings of Figures 1A-2B or the rungs of Figure 4A-4B.

25 That said, modest ledges or lips (not shown) could be fitted at one or both longitudinal ends of the wheel support platforms 114, as a reference point for (un)

loading.

Alternatively, for operational flexibility, the entire longitudinal span of the upper deck 107 could be fragmented into multiple (individually-movable) shutter assemblies 111, 112, selectively deployed or retracted, according to individual vehicle wheelbase and (un)loading or transit conditions.

Shutter operation could be manual, (bias) assisted or powered.

Constructionally, the shutter panels 111, 112 are interconnected by a hinge joint 117 along their adjacent edges.

For convenience of illustration, the left and right hand sides of Figure 8 show the deck shutters 111, 112 in different positions.

Thus, the right hand side of Figure 8 shows the deck shutters 111, 112 fully retracted, towards the associated deck beam 109.

The left hand side of Figure 8 shows the deck shutters 111, 112 fully extended, to provide an unfettered (un)loading ramp for vehicle wheel support from underneath.

Operationally, for (un)loading, the upper deck 107 is (temporarily) configured as continuous (albeit segmented) opposed ramps, 'comfortably' (ie with a safety margin) spanning the wheel tracks of the intended vehicle load.

Thus upper deck vehicles 103 can simply be driven on or off from one end.

Once loaded, the 'bridging' track portions between localised deck portions underlying vehicle wheels 102 can be withdrawn, to create a greater vehicle underbody clearance, allowing the localised intrusion of another vehicle load from underneath.

Specifically, fully-extended deck shutter panels 111, 112 are concertina-folded, from a mutually-aligned condition, in which they collectively form a flat platform ledge,

shown to the left of Figure 8, to a concertina-folded condition, shown to the right of Figure 8, in which only a marginal residual ledge remains.

5      Rotation of an underlying operating and support brace arm 113 in relation to the associated chassis rail 109, allows the outer shutter 112 to transit upwards and outwards into a parked position, upright alongside and inboard of the chassis rail 109.

The interconnection and pivot axis geometry of the brace 113 and shutters 111, 112 is such that over-centre location is achieved in both fully-extended and fully-retracted shutter conditions.

10      Shutter movement, can be initiated by driving upwards and rotating the brace 113, and/or the latter can follow shutter panel movement, say initiated or progressed by driving (pushing outwards) the inner shutter panel 111, or drawing (pulling outwards) the outer shutter panel 112

Deck shutter 111, 112 retraction creates an enhanced overall underbody and under-deck clearance.

15      In particular, the inboard shutter panel 111, which could otherwise intrude upon, and so conflict with, a region occupied by the roof of an underlying vehicle 101 - as shown to the left in Figure 8 - no longer becomes an obstacle.

20      This in turn allows the roof of an underlying lower deck vehicle 101 to be brought towards the underside floor plan of the overlying upper deck vehicle 103, by lowering the upper deck 107 in relation to the lower deck 105.

This represents a compact packing configuration for transit, as depicted in Figure 8.

For added security against inadvertent dislodgement, in transit, vehicles 101, 103 could be tied to their respective decks 105, 107 by, say, restraint straps (not show).

25      For unloading, the upper deck 107 is raised in relation to the lower deck 105, to restore the between vehicle operating clearance for safe (un)loading without risk of

vehicle collision.

In terms of overall container configuration, in this particular case, the transverse span of the upper deck 107 is less than that of the lower deck 105.

- 5 This could allow container collapse, say for unladen or-return empty transit and storage modes, with the upper deck 107 nested within the lower deck 105.

Referring to Figure 9 a variant twin, relatively-movable, dedicated vehicle container to that of Figure 8 is depicted.

Thus, corresponding parts to those of Figure 8 are given the same references and only substantive differences will be described.

- 10 Movable upper deck shutters 125 are configured as multiple (in this case three) entrained panels 121, running in a common curved guide track 126, inboard of an associated chassis rail 109.

Again the fully-extended or deployed shutter condition is depicted to the left of Figure 8 and the fully-retracted condition to the right.

- 15 Referring to Figure 10 a variant of Figures 8 and 9 - again with corresponding parts given the same reference - employs selectively removable deck panels 131, in place of interconnected shutters.

When installed, a deck panel 131 can sit upon, or in a recess in, a transverse deck panel 134, as shown to the left in Figure 10.

- 20 When (temporarily) removed, a shutter 131 can be disposed inboard of an adjacent chassis rail 109, as shown to the right of Figure 10.

Referring to Figure 11, a 'longitudinal' retractable-shutter variant of the 'transverse' shutters of Figures 8 through 10, is shown in side elevation.



An upper deck 147 is configured as a twin level beam, with a lower level 144 accessible through a retractable, inclined, shutter ramp assembly 151, extending in a shallow incline, from an upper level 145.

- 5      A vehicle load 143 on the upper deck 147 is depicted with its front wheels resting upon the lower deck level 144, whilst its rear wheels rest upon upper deck level 145 - so that the vehicle 143 as a whole is tilted, nose somewhat forward and downwards.

If the vehicle track is known, the upper deck 147 could be configured with 'permanent' localised wheel support, for either or both the front and rear wheels - with a temporary intervening ramp shutter span or bridge, for (un)loading by driving.

- 10     Tilted vehicle orientation itself promotes underbody clearance, for the potential intrusion of the roof of an underlying vehicle 141 upon a lower deck 154 - once the ramp shutter 151 has been retracted (not shown) - say, by sliding rearwardly under the upper deck level 145, or indeed removal altogether.

- 15     Localised wheel capture, and/or (lateral) restraint, provision 159 is available at lower level 144 of upper deck 147 - with equivalent facility 157A, 157B on lower deck 154.

A combination of the transverse retractable deck shutters of Figures 8 through 10 and the dual level deck of Figure 11 could be contrived, albeit possibly with localised deck recesses, into or from which vehicle wheels could make a more abrupt transition.

- 20     In the embodiments of Figures 8 through 11, only the upper decks are shown with retractable shutter provision. This allows sufficient relative vehicle to deck level adjustment for compact loading.

However, in principle, the lower deck could have similar provision - where loading efficiency justifies the complexity and attendant cost.

**Component List**

	10	dedicated vehicle transporter
	12	(lower) deck
	14	(upper) deck
5	15	localised wheel capture module
	16	slings/bands
	17	runner
	19	runner
	20	(deck) chassis
10	22	(lower) deck level
	24	(upper) deck level
	26	tension roller
	28	mounting tie
	30	vehicle
15	31	vehicle
	41	wheel tray
	50	lower deck
	51	wheel capture bar
	52	wheel capture bar
20	53	pivot arm
	54	pivot arm
	55	vehicle
	56	tilting deck portion
	57	actuator
25	58	pillar
	59	actuator

	60	upper deck
	61	tiltable deck portion
	63	tiltable deck portion
	65	vehicle
5	66	lower deck
	67	cable drive
	68	upper deck
	70	twin deck vehicle transporter
	71	central deck portion
10	72	tilting deck portion
	73	tilting deck portion
	75	vehicle
	76	lower deck
	77	vehicle
15	78	upper deck
	81	support post
	83	header beam
	84	adjustable outer frame element
	85	adjustable outer frame element
20	87	capture and handling fitting
	89	adjustable outer frame element
	90	tunnel gauge
	91	tunnel gauge
	100	twin deck container
25	101	vehicle
	102	vehicle wheel
	103	vehicle
	105	lower deck
	106	continuous platform
30	107	upper deck

	108	side chassis rail
	109	side chassis rail
	111	inner shutter panel
	112	outer shutter panel
5	113	support brace arm
	114	deck portion
	115	peripheral ramp
	117	shutter hinge joint
	121	shutter panel
10	125	upper deck shutter
	126	guide track
	131	deck panel
	134	transverse deck panel
	141	vehicle
15	143	vehicle
	144	upper deck, lower level
	145	upper deck, upper level
	147	upper deck
	151	inclined shutter ramp assembly
20	154	lower deck
	157A	wheel restraint
	157B	wheel restraint
	159	wheel restraint

**Claims****1. {Deck + load support}**

5 A load deck,  
with localised load support modules,  
positioned to allow closer packing of load,  
into a void between support modules.

**2. {Deck + load capture and re-orientation}**

10 A load deck,  
in which localised load support modules,  
capture and entrain a load,  
enabling load re-orientation or disposition,  
relative to the load deck/platform.

**3. {Variable Deck Infill}**

15 A load deck,  
as claimed in either of the preceding claims,  
with variable infill,  
to accommodate different load configurations,  
load levels or heights,  
and/or unloading or loading modes.

4. {Continuous Web or Sling Deck Infill}

A load deck,  
as claimed in any of the preceding claims,  
with variable infill,  
5 configured as a continuous web or sling,  
to accommodate different load configurations,  
and unloading or loading modes.

5. {Multiple Entrained Shutter Deck Infill}

A load deck,  
10 as claimed in any of the preceding claims,  
with variable infill,  
configured as multiple entrained shutter panels,  
to accommodate different load configurations,  
and unloading or loading modes.

15 6. {Removable Deck Portions}

A load deck,  
as claimed in any of the preceding claims,  
with localised load supports,  
and intervening movable deck portions  
20 forming a continuous deck for load transit and positioning;  
deck portion movement, upon load placement,  
allowing compact load packing,  
into a void accessed by deck portion movement.

## 7. {Deck Shutter}

A load deck,  
as claimed in any of the preceding claims,  
with loading track,  
5 configured as a movable shutter;  
an extended configuration ,  
forming a continuous support,  
for load transit along the deck;  
with shutter retraction, upon loading,  
10 between localised load supports,  
for compact load packing  
by protrusion of underlying load  
into void accessed by shutter retraction.

## 8. {Longitudinal, Transversely Movable Shutter - Figures 8 &amp; 9}

15 An elongate load deck,  
as claimed in any of the preceding claims,  
including a (re)movable deck portion,  
configured as co-operatively inter-coupled shutters,  
aligned longitudinally with the deck,  
20 and deployable or retractable transversely of the deck.

## 9. {Transverse, Longitudinally Movable Shutter - Figure 11}

An elongate load deck,  
as claimed in any of the preceding claims,  
including a (re)movable deck portion,  
25 configured as co-operatively inter-coupled shutters,  
aligned transversely with the deck,  
and deployable or retractable longitudinally of the deck.

## 10. {Container Format}

A load deck,  
as claimed in any of the preceding claims,  
with a containerised format.

## 5      11. {Load Deck as Illustrated}

A load deck,  
substantially as hereinbefore described,  
with reference to, and as shown in,  
any of the accompanying drawings.

## 10      12. {Vehicle Transporter with Load Deck}

A vehicle transporter,  
with a load deck as claimed in any of the preceding claims.

## 13. {Vehicle Transporter Packing}

15      A vehicle transporter,  
with localised load support modules,  
positioned to allow closer packing of load,  
into a void between support modules.

## 14. {Vehicle Transporter Load Level Adjustment}

20      A vehicle transporter,  
including a plurality of support modules,  
locally to support individual vehicle wheels,  
and operable to adjust vehicle load level, or height.



## 15. {Deck Tracks}

A vehicle transporter,  
comprising a (vehicle) load deck,  
with vehicle wheel support and guidance tracks,  
5 the tracks being segmented.  
with track segments configured as movable deck shutters,  
selectively deployable,  
collectively to form a load transit path, for (un) loading,  
and retractable, between residual, local vehicle support portions,  
10 for vehicle underbody access, by another (vehicle) load.

## 16. {Deck Shutters}

A vehicle transporter,  
with a plurality of deck shutters,  
selectively deployable for vehicle guidance,  
15 and retractable between localised wheel supports.

## 17. {Movable Deck Shutters}

A vehicle transporter,  
comprising a (vehicle) load deck,  
with movable deck shutter portions,  
20 between localised vehicle (wheel) deck supports,  
and deployable from an extended position,  
bridging or spanning those supports, for vehicle (un) loading,  
and a retracted position, for transit,  
and enabling load intrusion between vehicle wheels.

## 18. {Deck Tilting}

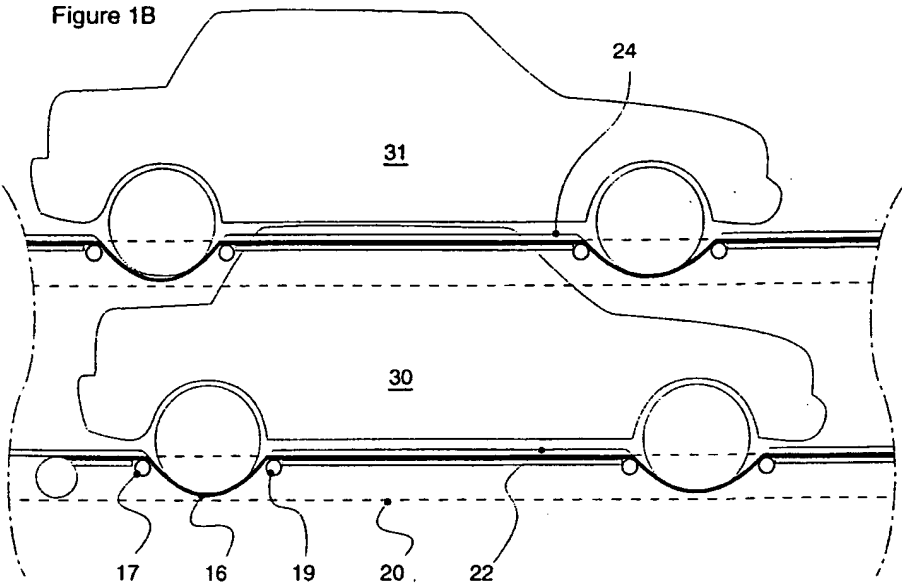
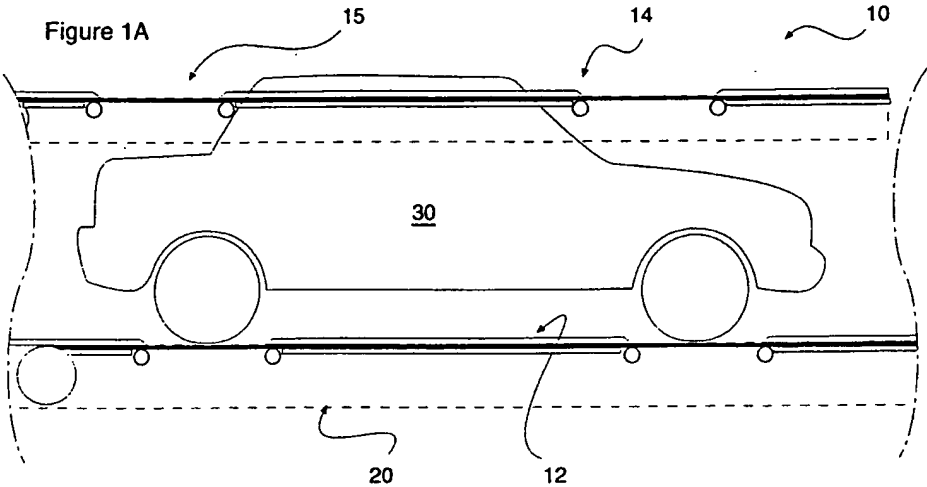
5 A vehicle transporter,  
as claimed in any of the preceding claims thereto,  
comprising a movable (tiltable) load deck portion,  
in which localised wheel support modules,  
capture, restrain or entrain vehicle wheels,  
enabling vehicle load re-orientation or disposition.

## 19. {Containerised Vehicle Transporter}

10 A vehicle transporter,  
as claimed in any of the foregoing claims thereto,  
configured to a containerised format.

## 20. {Vehicle Transporter}

15 A vehicle transporter,  
substantially as hereinbefore described,  
with reference to, and as shown in,  
any of the accompanying drawings.



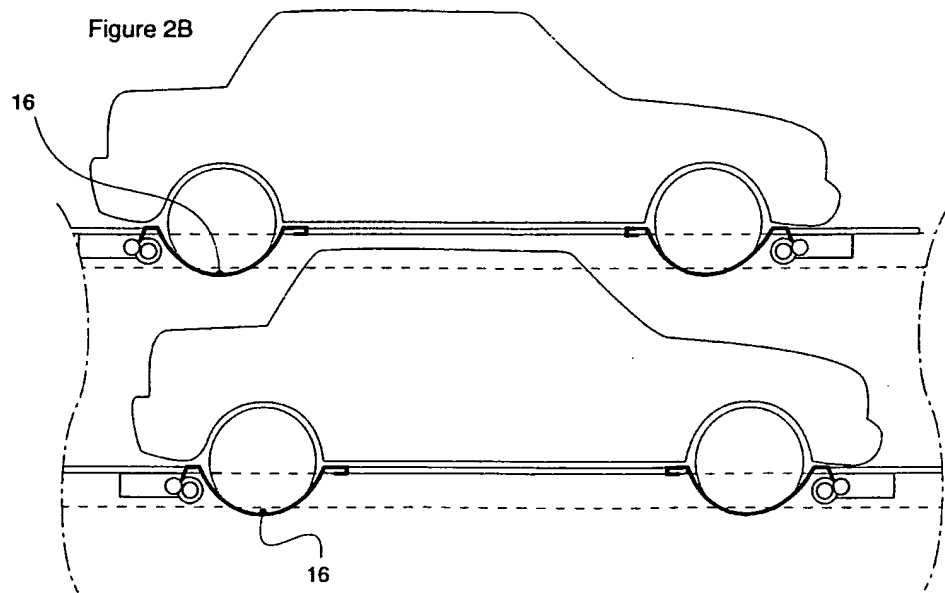
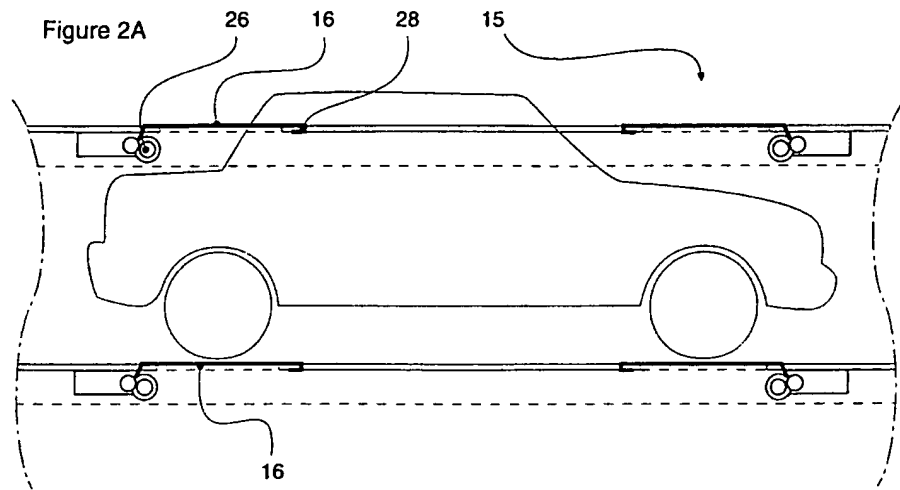


Figure 3A

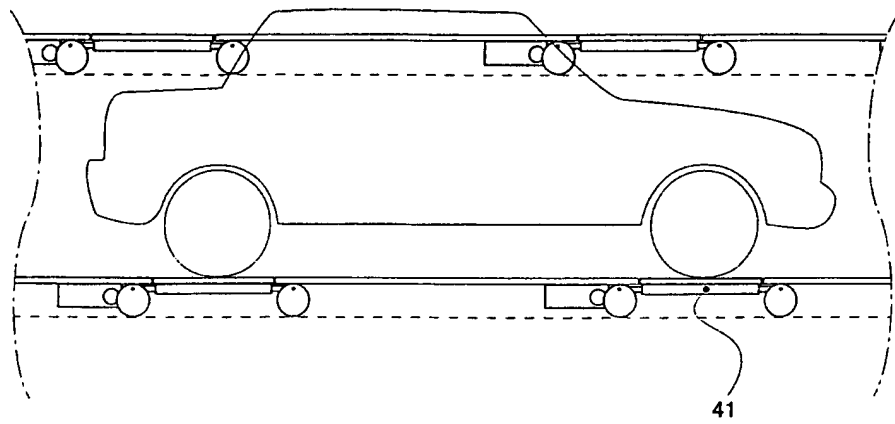
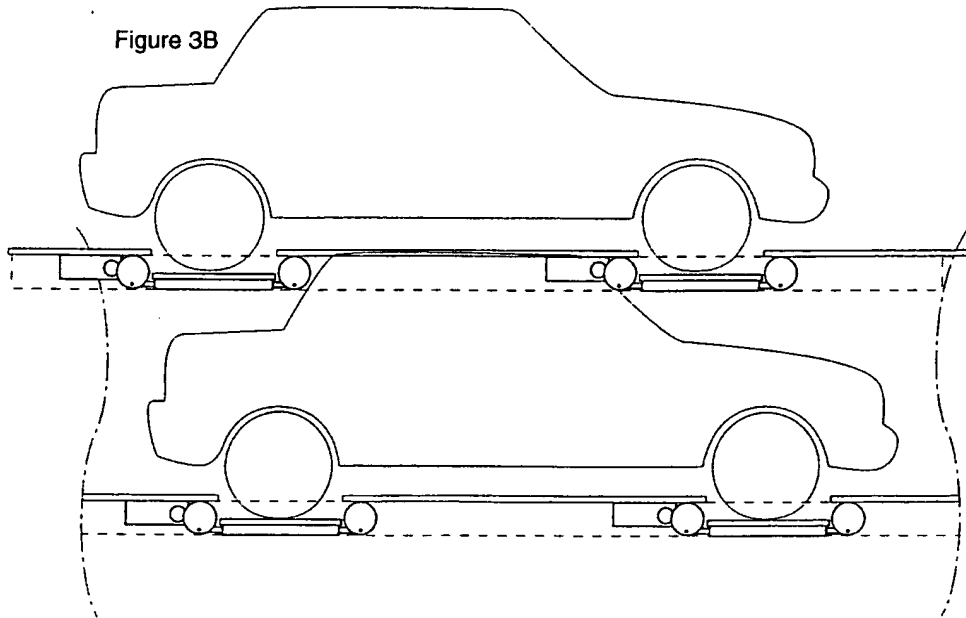
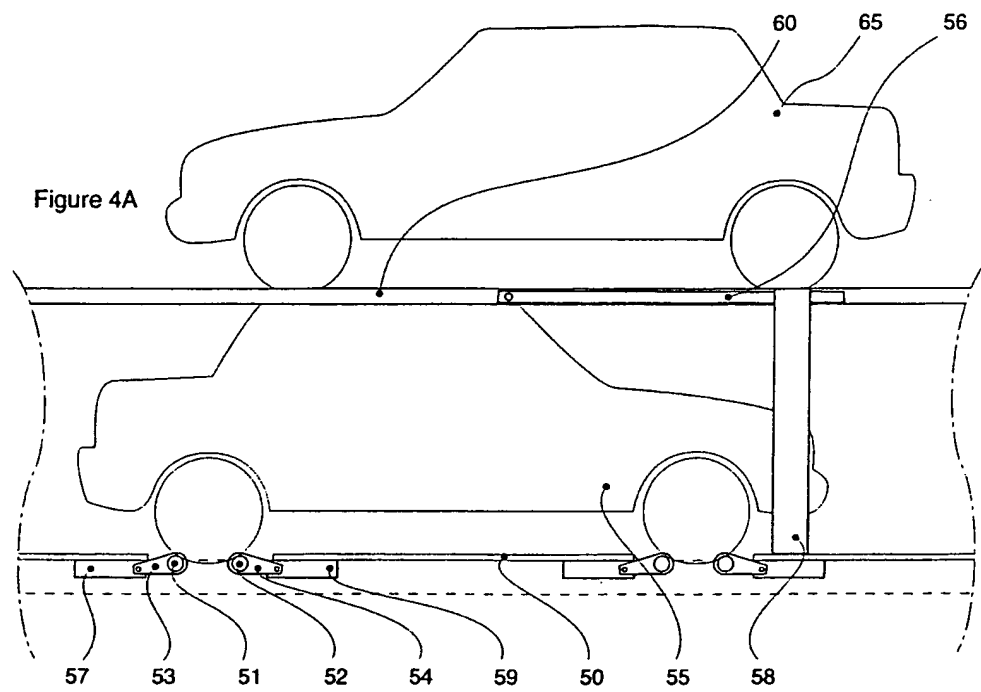


Figure 3B



**Figure 4A**



**Figure 4B**

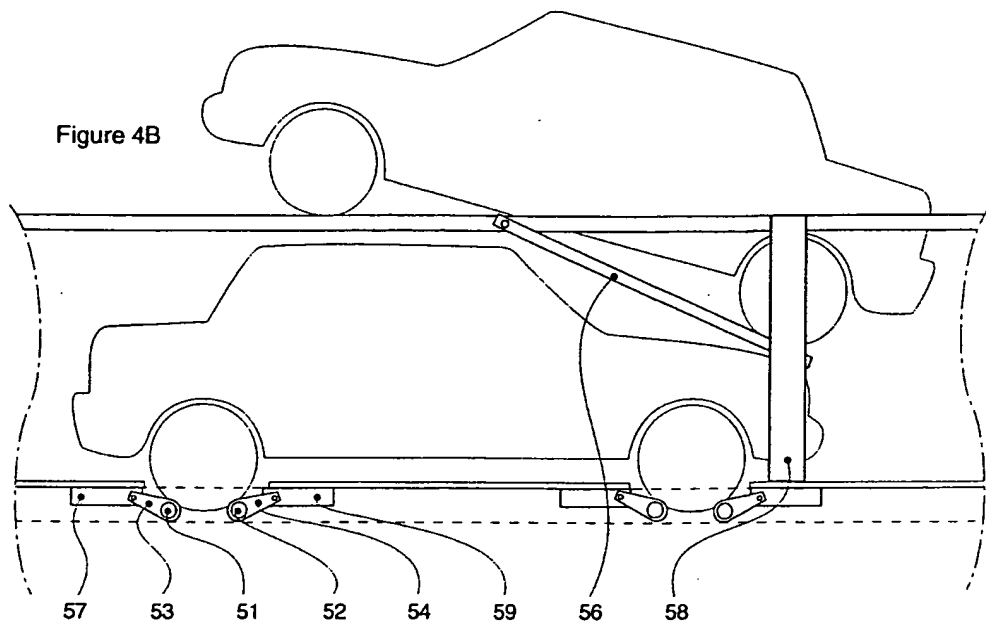


Figure 5A

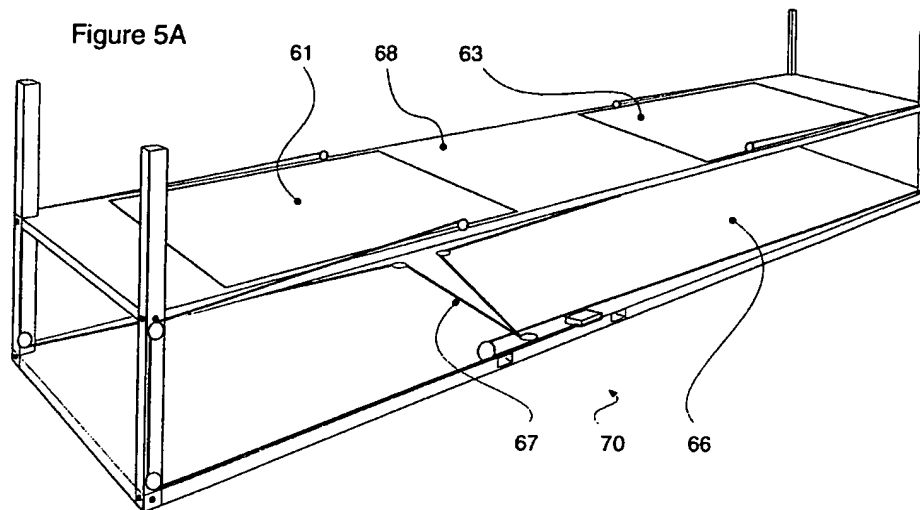
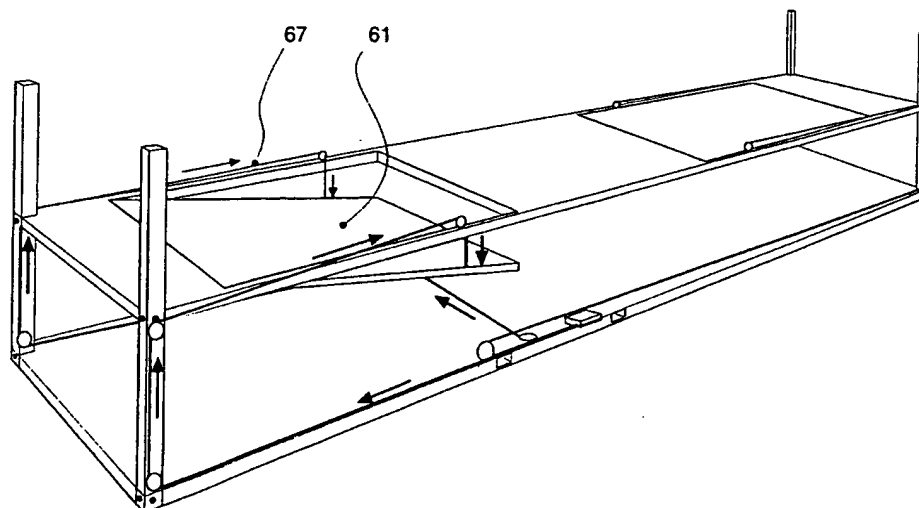
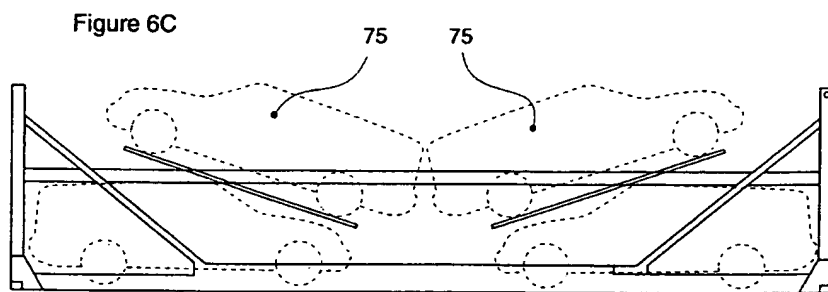
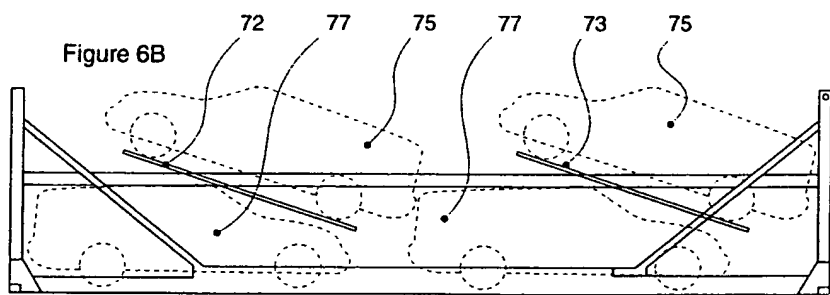
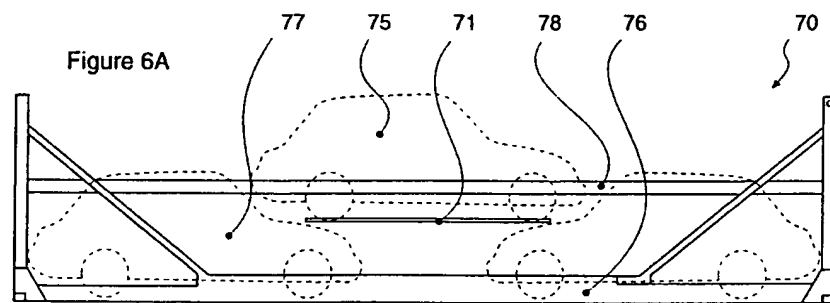


Figure 5B







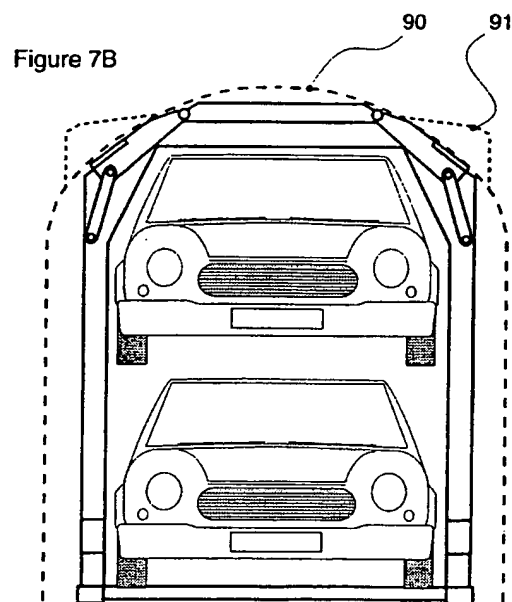
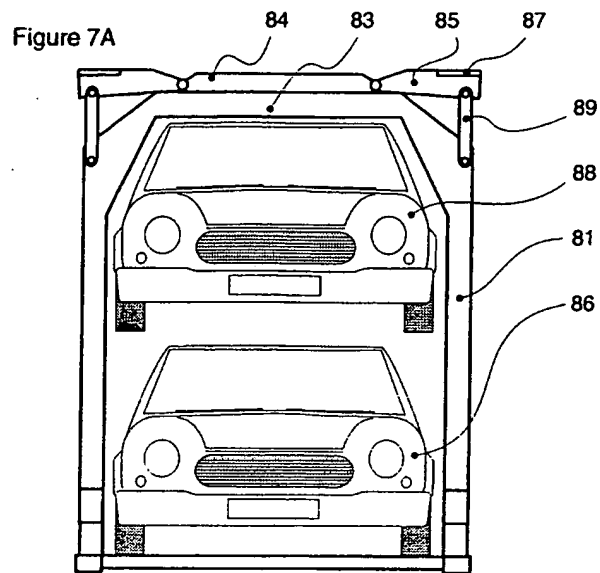


Figure 8

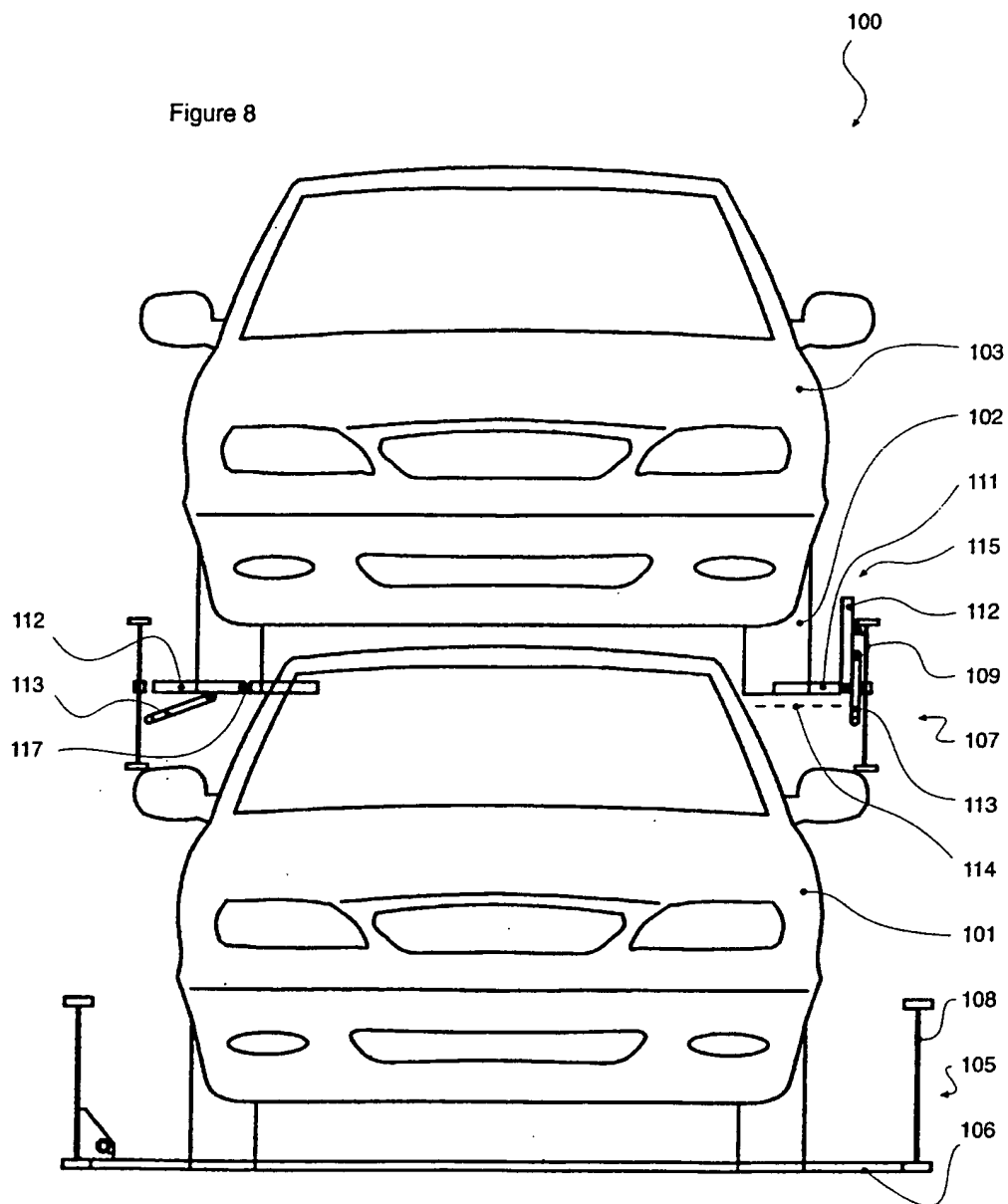


Figure 9

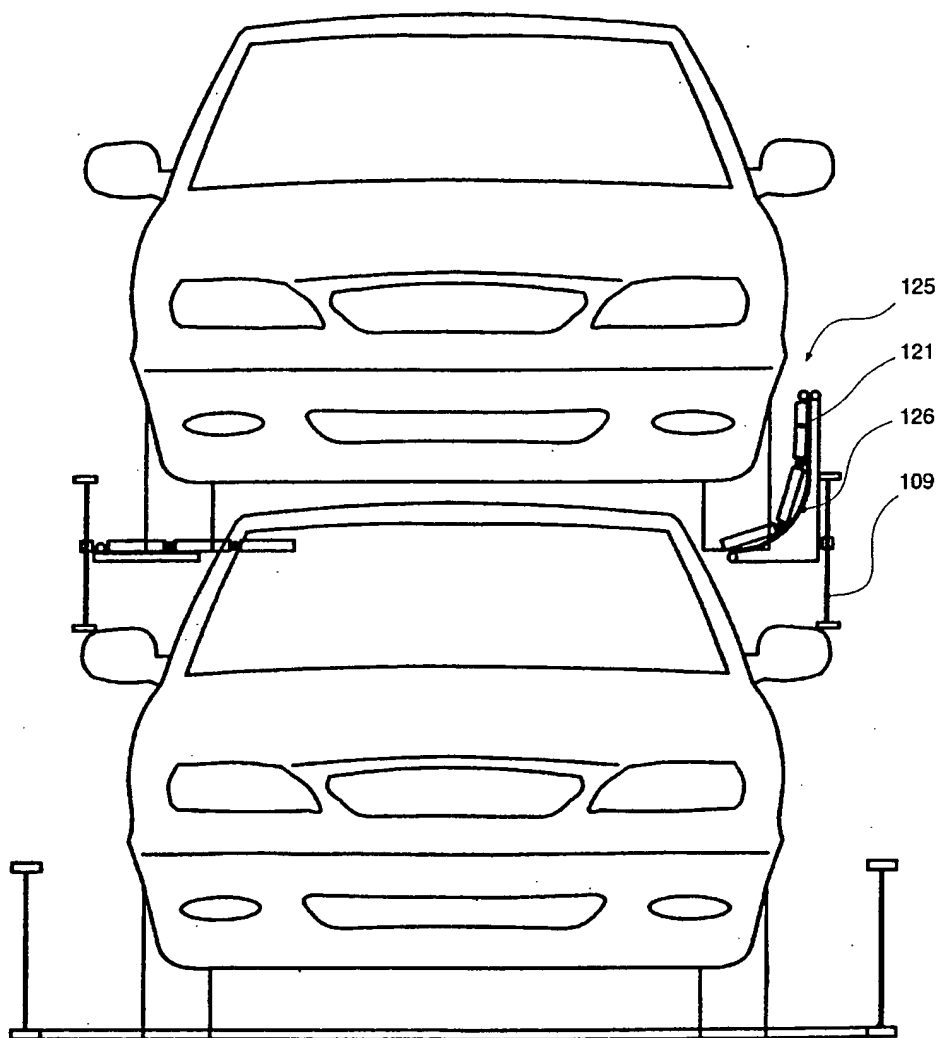


Figure 10

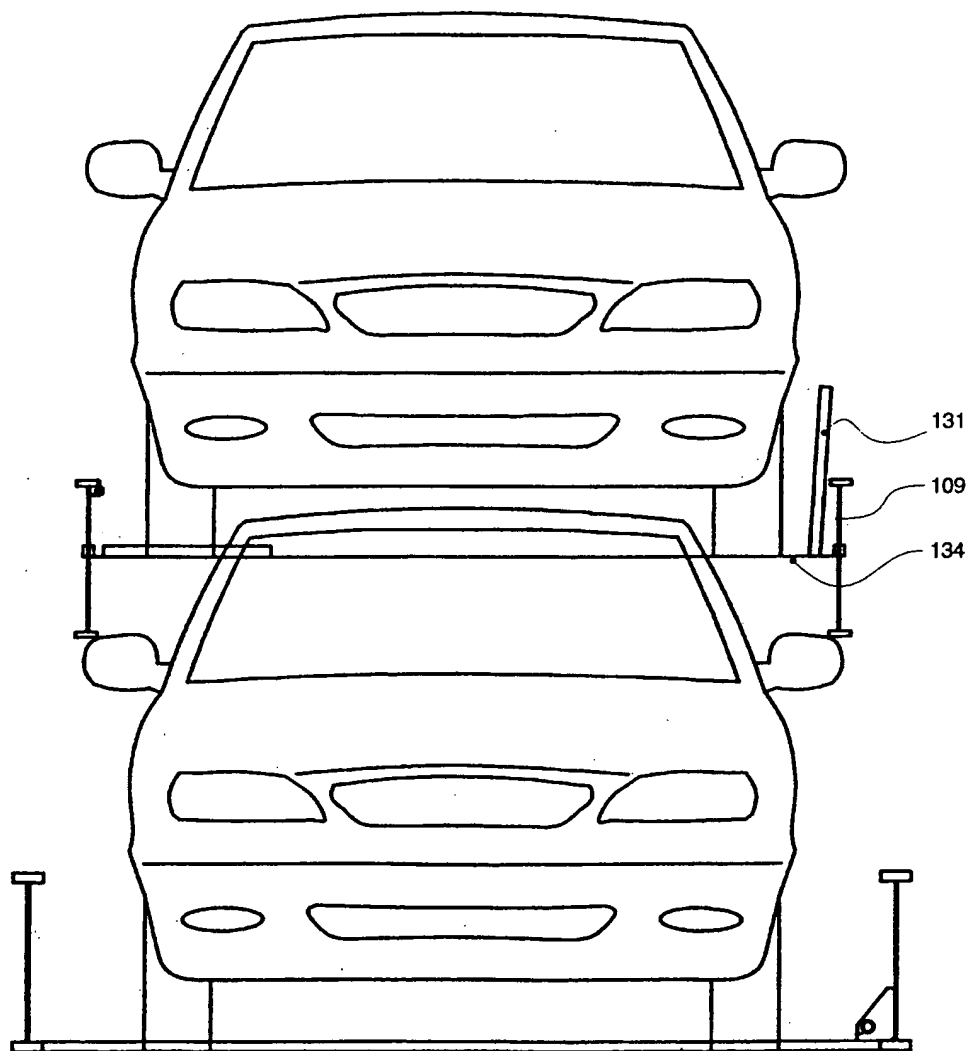
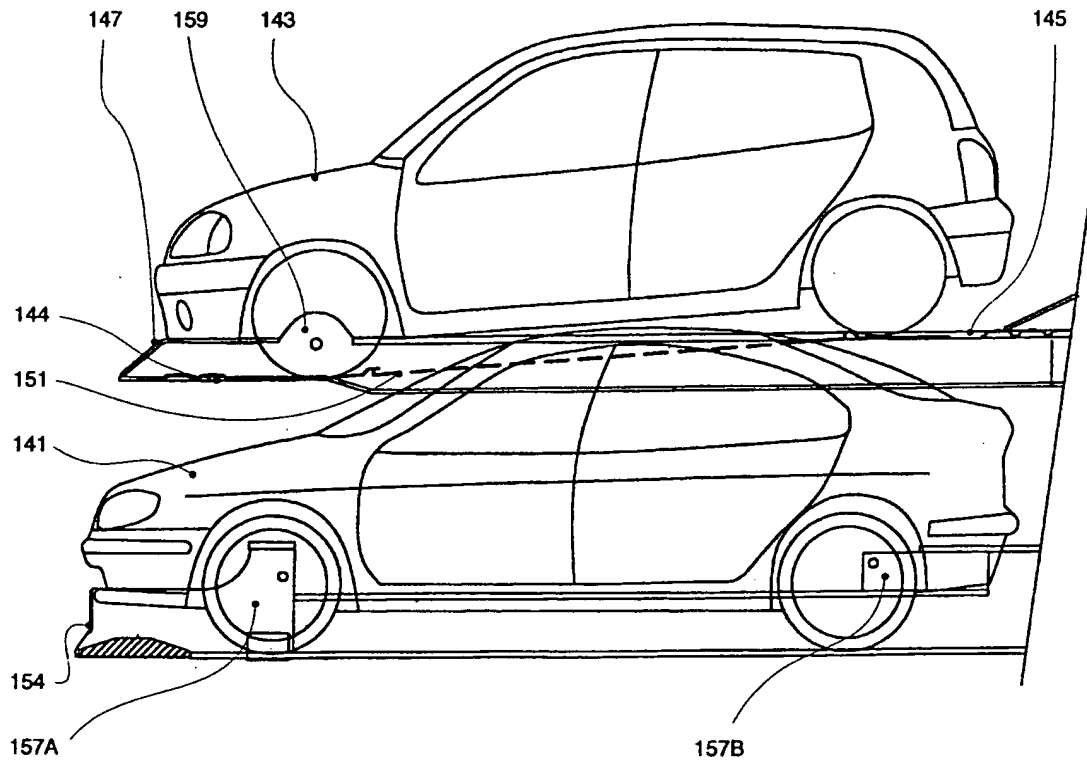


Figure 11



# INTERNATIONAL SEARCH REPORT

Int. Application No

PCT/GB 00/01896

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B60P3/08 B65D88/12

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B60P B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

PAJ, EP0-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	PATENT ABSTRACTS OF JAPAN vol. 003, no. 093 (M-068), 8 August 1979 (1979-08-08) & JP 54 067939 A (NISSAN MOTOR CO LTD; OTHERS: 01), 31 May 1979 (1979-05-31) abstract	1-3, 5-7, 11-20
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X	WO 98 09889 A (CLIVE SMITH MARTIN) 12 March 1998 (1998-03-12) cited in the application claims 1,3,5,6	1-3, 15-20
A	idem	8, 11-14
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Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

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Date of the actual completion of the international search

11 October 2000

Date of mailing of the international search report

20/10/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Beernaert, J

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/01896

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 4 124 119 A (NORDSTROM ARNOLD B) 7 November 1978 (1978-11-07) the whole document ---	1-20
A	US 4 759 668 A (LARSEN STUART A ET AL) 26 July 1988 (1988-07-26) figure 5 ---	1-20
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Information on patent family members

Int. l. Application No

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